Intervention strategies for improvement of disasters risk perception: Family-centered approach

Hesam Seyedin, Ezat Samadipour[1], Ibrahim Salmani[2]

Abstract:

Introduction: Today, the role of people in crisis management plans is of particular importance due to the prepared community approach. It is difficult or impossible to attract public involvement due to the low level of public perception of risk. Therefore, it is necessary to discover the status of risk perception and its affecting factors. This study was conducted to investigate factors affecting the strategies of disaster risk perception improvement.

Materials and Methods: This systematic review study was conducted in 2017 using extensive electronic and library literature searches in the Web of Science, Scopus, and PubMed electronic databases. The preliminary findings included 1030 studies. Out of 941 retrieved references, 925 references were excluded because they did not meet the objectives of this review or did not focus directly on general population. Finally, 16 articles were selected for further investigation.

Results: The extracted variables were divided into four general domains: personal, psychological, socioeconomic, and cultural factors. Personal characteristics included sex, age, marriage, level of education, personal knowledge, and disaster personal experience. Psychological factors comprised emotions (fear and insecurity), mental images (beliefs, attitudes), and internal and external control. Cultural factors such as, belief, values, norms, faith, religious, and protective spirit were effective in general perception of disasters risk. Socioeconomic factors such as, income, livelihood, insurance coverage, trust, and fair access to land and resources were also influential. The strategies to improve public disaster risk perception were educational, participatory, incentive, confidence building, supportive, managerial and cultural ones. A family-centered approach is recommended for the better implementation of strategies.

Conclusion: The improvement of risk perception requires government planning in different fields such as education, research, health, and culture, with an emphasis on social groups especially family.

Keywords:

Community based, crisis management, disaster management, emergency management, family-centered, risk management, risk reduction, risk perception, systematic review

Department of Health in Disaster and Emergencies, School of Health Management and Information Sciences, Iran University of Medical Sciences, Tehran, Iran, [1]Department of Health in Disaster and Emergencies, School of Health Management and Information Sciences, International Campus (IUMS-IC), Iran University of Medical Sciences, Candidate in Health in Disasters and Emergencies, Tehran, Iran, [2]Department of Health in Disaster and Emergency, School of Public Health, Shahid Sadoughi University of Medical Sciences, Yazd, Iran

Address for correspondence:
Dr. Ezat Samadipour, Department of Health in Disaster and Emergencies, Candidate in Health in Disasters and Emergencies, School of Health Management and Information Sciences, International Campus (*IUMS-IC*), Iran University of Medical Sciences, Tehran, Iran. E-mail: samadipourez@gmail.com

Introduction

The risk and impact of disasters have continued to increase in the past decades.[1] Evidence shows that the exposure of individuals to disaster risks is growing much faster than the ability to reduce vulnerabilities to them.[2,3] Effective disaster management and reduction of disasters risk are cost-effective approaches to prevent future damages, contributing to the sustainable development and capacity-building of countries.[4] One of the important conceptual frameworks in the sustainable development approach is the disaster management framework. This framework a comprehensive plan dealing with protection of people in a society, their properties, and their environment.[5,6]

Today, disaster manager tend toward community-preparedness approach for

disaster management. This approach emphasizes the important roles and responsibilities of the members of the community in establishing disaster management programs and systems, ensuring self-sufficiency, and reducing vulnerability in times of disaster.[3,7] Understanding the risk is the first priority for disaster risk reduction global planning.[8] Perceiving the risk of disasters is mainly of universal and theoretical nature and is a means of achieving risk understanding. Moreover, perception plays a key role in motivating individuals to avoid, accept, reduce, and transfer risk.[9] Clearly, in order to achieve the community preparedness, we need to improve the perceived risk of disasters at the community level.

Perceptions are mental processes that internalized through social and cultural education and are continuously moderated by media reports, peer impact, and other communication processes. Perception varies depending on the type of risk, individual's background, and social context.[10,11] Due to the complexity and multidimensionality of public risk perception and the effects of social, cultural, economic, and environmental variables on risk perception and its relation to behavioral outcomes, risk perception has remained in a state of ambiguity.[12,13]

Wachinger *et al*. state that despite the large number of empirical studies on risk perception and personal action, the relationship between risk perception and behavioral responses to readiness is still unclear and controversial. It is generally assumed that a high-risk perception will lead to personal protection. However, this is not always the case, and it depends on many underlying factors.[14]

Risk perception interventions must be integrated at different levels of management and can have a positive effect on community participatory in disaster risk reduction program. Thus, proper risk perception interventions can raise community participatory in reducing risk programs, reduce the damages induced by the disasters, and reinforce preventive behaviors at the community level. Therefore, we conducted a systematic review to access and aggregate the evidence on the public risk perception interventions and second to achieve a consensus in this regard.

Materials and Methods

Systematic search
This systematic review included previous studies on risk perception, especially those focused on natural disasters, human-made disasters, and multiple disaster events. Articles published during January 2000 to June 2017 were considered. International databases such as Web of Science, Scopus, and PubMed were searched using

the keywords of disaster, perception, strategy, and risk reduction. The search was restricted to title, abstract, and key words. The search themes were combined using the Boolean operator "AND" and "OR." In the following, an example of search strategy is presented:

(Disasters OR crises OR crisis OR emergency OR emergencies) AND (Risk OR Hazard OR Danger) AND (perception OR understand * OR Aware * OR cognition OR insight OR intention) AND (Strategy * OR Deal * with OR promotion OR manage * OR cop * with).

Article selection
All articles in this regard published in English from 2000 to 2017 were included. In addition, the reference lists of the reviews were searched to identify other studies that meet our defined inclusion criteria. The title and abstracts of the papers were reviewed by the authors to select papers. The selected publications were then read in full.

Data extraction
Descriptive and thematic analyses were performed on the selected articles. One of the authors extracted data from all the included studies using a datasheet and focusing on descriptive and thematic variables [Tables 1 and 2]. The accuracy and completeness of the extracted data were checked by other authors and a number of experts in this field.

Results

This section presents the results of the literature review with a special focus on factors that affected risk perception and strategies for the improvement of risk perception. The preliminary findings with the above key words included 1030 studies. Out of 941 retrieved references, 925 references were excluded because they did not meet the objectives of this review or did not focus directly on the general population. Finally, 16 articles were selected for further investigation [Figure 1].

Seven studies out of 16 studies (43.75%) were conducted in Europe, 4 (25%) in America, 3 (18.75%) in Asia, and 2 (12.5%) in Oceania.

The selected studies were screened for the main factors responsible for determining risk perception and categorized into four groups, including personal factors, psychological factors, socioeconomic factors, and cultural factors.

Personal factors
Personal factors comprised age, sex, marital status married, level of education, personal knowledge, and personal disaster experience. Some studies have shown that age is effective in risk perception;[12,21,27]

Table 1: Systematic review of literature for intervention strategies for DRP improvement (2000–2017)

Number	Reference	Method	Country	Factor investigated	Outcome
1	Rethinking the relationship between flood risk perception and flood management[10] 2014	Review	-	The overarching overview of the theoretical development was to understand the "rational" and "structural" danger	Sociocultural concepts are most closely associated with structuralism, in terms of vulnerability, capacity, resilience, and motivation. Structural studies provide a greater understanding of the impact of the flood of experience, history, beliefs, communications, and individual and collective understanding
2	Perception of flood risk in Danube Delta, Romania[11] 2009	Mix method	Romania	Reveal the conscious and unconscious attitudes toward the flood risk for the inhabitants/psychological approach	Two psychological factors as essential in establishing the psychosocial vulnerability degree of the interviewed participants: (i) An internal control factor and (ii) an external control factor
3	Public perceptions and attitudes to biological risks: Saudi Arabia and regional perspectives[12] 2016	Quantitative	Saudi Arabia	Attitude of Saudi society, specific culture, and demographic factors, to biological risks/cultural approach	Faith, education, and tendencies and experiences and the participation of religious leaders were effective in understanding the risk
4	The risk perception paradox-implications for governance and communication of natural hazards[13] 2013	Qualitative systematic review	-	Review the results of previous interdisciplinary studies on risk perception and behavioral responses associated with natural hazards	Personal experience, trust in authorities and experts have the greatest impact on the level of perceived risk. Media coverage, age, gender, education level, income, and social status are merely mediators or reinforcement of cause and effect dependencies between experience, trust, understanding, and readiness
5	Cross-cultural and site-based influences on demographic, well-being, and social network predictors of risk perception in hazard and disaster settings in Ecuador and Mexico[15] 2013Ẇ	Qualitative	Mexico Ecuador	Better understanding of risk perceptions between cultures, social networking, and social structure structures	In predictors of perceived risk in different regions demographic factors (age, sex, level of education, population density, and religion) of welfare (social and economic). There was little overlap. Stress in Mexico and social networks in Ecuador were effective in understanding the dangers of the past
6	Understanding the disaster experience of older adults by gender: the experience of survivors of the 2007 earthquake in Peru[16] 2010	Qualitative	Peru	Research on understanding Peruvian survivors' experience in cultural context and gender roles and family relationship	Men tend to focus on the tangible effects of disaster, while women have more emotional concerns. The strengths of the elderly in the context of their gender role can be used to develop focal and educational programs
7	Preparing for natural hazards: normative and attitudinal influences[17] 2007	Quantitative Questionnaire and analysis with structural equation method	New Zealand	Positive attitudes, facilitating readiness, and restricting their negative attitudes The intention to seek information is related to the negative attitude toward the negative perceptions and negative norms that make adjustment work/social approach	The idea of reducing harm (expecting consequences) and problem-solving skills and probability compatibility will increase the protection objectives

Table 1: Contd...

Number	Reference	Method	Country	Factor investigated	Outcome
8	Enhancing seismic risk mitigation decisions: A motivational approach[18] 2011	Mix method	New Zealand	How does the motivational process affect the disaster preparedness based on human reason and decision-making? How can this motivational process be increased/social approach?	Living in an earthquake area is not enough incentive to retrofit. Collaborative strategies include upgrading the intention to behave with the use of stories related to past earthquake experiences, the formation of a seismic risk reduction association, and more
9	Dependence of flood risk perceptions on socioeconomic and objective risk factors[19] 2009	Quantitative	The Netherlands	Investigating the effect of flood experience on perceived risk of Dutch households/realistic approach	The attitudes of the people with a perceptible flood hazard were directly related to the distance from the river. Due to lack of flood perception, awareness is not low, but fear and experience have a positive impact. Age and education had a reverse relationship with the perception of the flood
10	Living with increasing floods: Insights from a rural Philippine community[20] 2008	Mix method	Philippines	How do people understand the natural hazards of the Philippines and what are the corrective strategies for reducing community-based disaster risk?	People's capacity is rooted in their daily lifestyle capacity. The ability of individuals to regulate daily life is heavily dependent on livelihood and social networks. The best way to sustain and raise the capacity of CBDRR people is to assess the need and methods for their sustainability. Structural and technical prevention does not reduce the daily suffering of people
11	Implementing a transboundary flood risk management plan: A method for determining willingness to cooperate and case study for the Scheldt estuary[21] 2013	Quantitative	Belgium and the Netherlands	The purpose of this study is to support the overall assessment of the risk management, risk management program, and to assess the risk willingness to pay for a risk in two different locations for comparing risk management plans	A public information campaign on evacuation and trauma management can increase the willingness to pay. The campaign and campaign to reduce the risk of flooding to inform the public about misguided strategies and ignoring press events
12	The anticipated emotional consequences of adaptive behavior impacts on the take-up of household flood-protection measures[22] 2012	Quantitative	England	Investigate the relationship between ideas and experience in flood protection behavior	Protective behavior was associated with beliefs about anxiety and dependence on The experience of flooding increased the belief in protective behavior. There was a negative correlation between the protective behavior and the beliefs expressed about the financial consequences of the accident
13	Bam 2003 earthquake disaster: On the earthquake risk perception, resilience, and earthquake culture - Cultural beliefs and cultural landscape of Qanats, gardens of Khorma trees, and Argh-e Bam[23] 2015	Qualitative	Iran	How does the cultural perspective of cultural ideas affect the perceived risk of earthquake and resilience in Bam/cultural approach?	The cultural beliefs of the community are effective on resilience Beliefs related to persevering culture have had a direct impact on the overall perceived risk and preparedness of the earthquake. The belief in the palm trees, the Qanats, and the Bam citrus, although it did not diminish the effects of the earthquake but was effective on subsequent resilience
14	Is a picture worth a thousand words? The effects of maps and warning messages on how publics respond to disaster information[24] 2017	Experimental Scenario based	California, America	How do people who are at risk to respond to alerts?	Fear is effective in decision-making and has direct impact on accepting alerts and sharing information Searching for information with strong emotions and past experience has direct relevance

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Number	Reference	Method	Country	Factor investigated	Outcome
15	Concern about petrochemical health risk before and after a refinery explosion[25] 2008.	Mix method	Texas, USA	The study of social, psychological, behavioral and physiological factors related to health	The concern of the groups was related to the psychological and physical harm caused by the local petrochemical activity
16	An Analysis of the Public Perception of Flood Risk on the Belgian Coast[26]	Quantitative	Belgic	The study of sociodemographic factors, residence characteristics, location and hazard experience, location and permanent residence	Older people, women, and people with flood experience have higher perceived levels of coastal flood risks. Home ownership was not related to risk perception

CBDRR=Community Based Disaster Risk Reduction, DRP=Disater Risk Perception
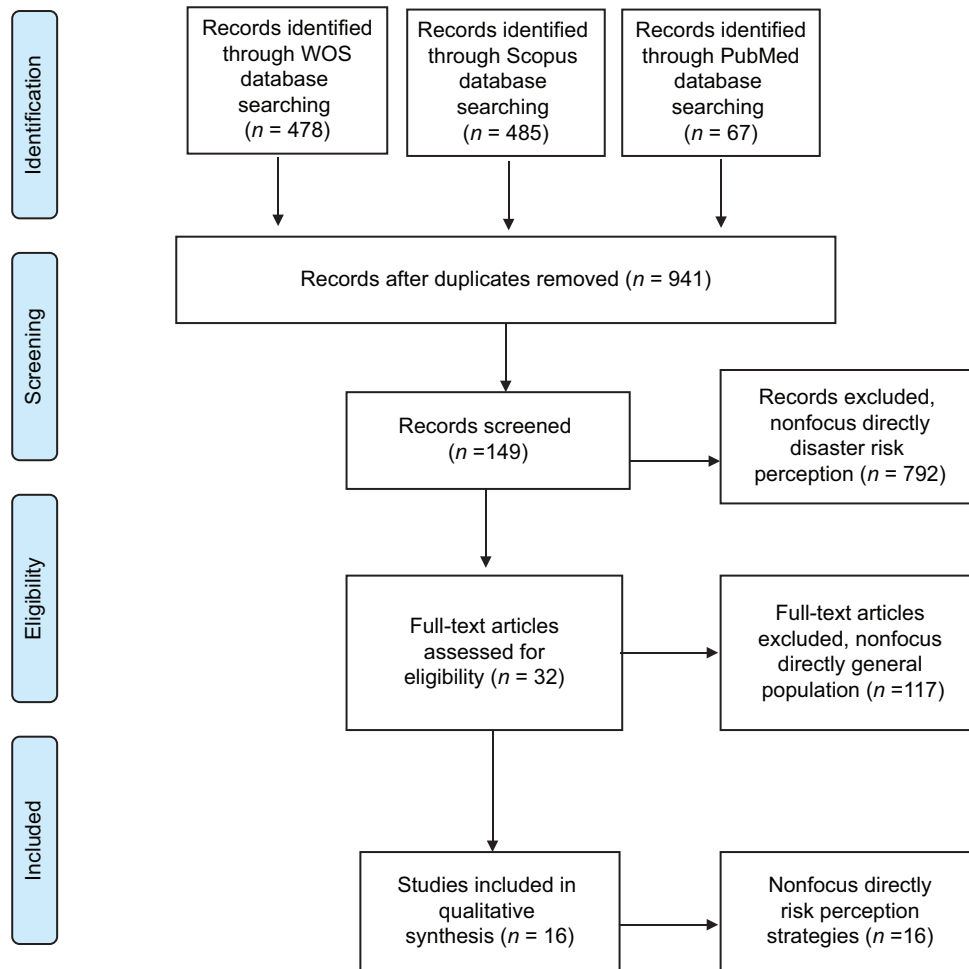

Figure 1: PRISMA flowchart diagram of the searched and selection of papers

whereas, others reported no or little effect of age on risk perception.[18,28-31] There is controversy about the importance of this factor, and in one study, lower risk perceptions of young people than older people were reported. According to the aforementioned study, humans with rational growth are able to understand risky situations and young people perceive risk less than older ones and they are mostly risk-takers.[31] On the other hand, Zagonari revealed that older people had less perception of risk due to lower level of awareness.[28,22] It seems that the factor of age is mediated by other intervening factors (e.g., education).

Although a mediating or reinforcing role was reported for sex in selected studies, difference in risk perception of males and females was frequently reported. Men tend to focus on the concrete effects of disasters, while women pay attention to emotional concerns.[15,23,27] According to literature, women are more concerned and more anxious, thus less risk-taking.[20,27] Catechin *et al*. described sex as an effective factor in perception and concluded that women had a higher risk perception.[32] Arma (2009) believes that the more orientation of women toward a foreign location makes them less able to control themselves and lessens their ability to stand during an

Table 2: Thematic analysis of the investigated papers: Disaster risk perception strategies

Author (s) reference	DRP strategies: Findings of this study 1. Educational strategies 2. Participatory strategies 3. Incentive strategies 4. Confidence building strategies 5. Supportive strategies 6. Managerial strategies 7. Cultural strategies
	Strategy for the improvement of DRP in literature review
Birkholz *et al.*[10]	6: Understandings the relationship between risk perception and flood management
	5: Political system of society, marginalization problems
	1: Knowing that all facets of society, not just those "at risk," have a role in shaping how risk is understood and ultimately dealt with
	6: Considering a research agenda for flood risk perceptions that is comprehensively underpinned by constructivist understandings
Armaş and Avram[11]	1: Increasing the degree of internal control
	6: Having a better educational level
	4, 5: If social support and the trust in authorities increase, the perceived or unconscious level of stress these people experience would drop. Lowering the stress levels would lead to an emotional balance
	5: The lack of resources, implying low resilience, strengthens unadaptive behavior
	3: Faith in support, strengthens adaptive behavior
	1: Conscious and unconscious attitudes
	6: Professionally active and better-paid subjects
Alshehri *et al.*[12]	1: Awareness raising
	1: Training
	1, 6: Access to timely and relevant information and knowledge
	1,3: Willingness
	6: Building on cooperation between official organizations
	1, 5: Developing its website
	6: Investigating the reasons behind the currently limited public usage and distrust of the site
	7, 3: Taking into account the use of faith, knowledge, and Islamic teachings to create a stronger incentive
	1, 7: Religious leadership partnership
Wachinger *et al.*[13]	4: Trust in authorities is necessary to build up a social climate in which advice from authorities will be taken into account in a crisis situation
	5, 1: Empowering the individual to imagine the effects of a disaster
	3: Encouraging citizens to take more personal responsibility for protection and disaster preparedness
	2: Designing the most appropriate measures for effective risk communication, stakeholder involvement, and emergency preparedness
Jones *et al.*[15]	5: Welfare (social and economic)
	5: Received social support (emotional, material, and informational)
	5, 6: A wealthier personal network
	6: The level of people's proximity to one another
	7: Religious affiliation
	7, 1: Psychometric and cultural approaches toward risk perception
Shenk *et al.*[16]	1: Elderly women role in education
	1: Strengths of older adults within the context of their gendered roles can be utilized to develop focused planning and educational efforts
	1: Drawing on older adults' skills and strengths in adjusting to changes caused by their experiences of disaster
McIvor and Paton[17]	3: Using incentive strategies
	5, 6: Protective measures for target communities, groups, families, and friends
	5, 6: Attention to change and facilitating social behavior
Egbelakin *et al.*[18]	4: The provision of extrinsic interventions is likely to annul the dilemma of procrastination with respect to adopting long-term risk reduction measures
	6: Mandatory disclosure of seismic risks would enhance an owner's level of perceived benefits from retrofitting through increased property value
	6: Effective policy adoption and implementation constitutes a central element in the overall framework for improving

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Author (s) reference	DRP strategies: Findings of this study 1. Educational strategies 2. Participatory strategies 3. Incentive strategies 4. Confidence building strategies 5. Supportive strategies 6. Managerial strategies 7. Cultural strategies
	6, 3: Policy implementers must fully understand their socioeconomic environments and the need to develop effective incentives and reward mechanisms before applying the proposed interventions
	2: Adopting a proactive mitigation approach and community engagement in order to achieve consistent earthquake mitigation strategies across the regions
	1, 6: Implementing intrinsic and extrinsic interventions to enhance seismic adjustment decisions
	1: Intensifying the use of the mass media
	1: Creating critical awareness motivators such as reiterating past earthquake experiences
	7: Intensifying coping strategies among community members
	5: Employing policy entrepreneurs at all levels of government to increase the salience of seismic risks
	5: Allocating extrinsic interventions such as financial incentives, namely, low-interest loans and tax deductibles
Botzen *et al.*[19]	5: Communicating adaptation measures potential to eliminate risks is likely to increase their attractiveness to individuals
	1: Having dread feelings toward flood risk
	2: Adopting a participatory approach toward flood risk management involving governments and citizens
	2, 3: An understanding of household attitudes and values toward risk reduction measures is fundamental to achieve effective protection against flooding
Gaillard *et al.*[20]	6: Disaster reduction strategies and increased adaptability of people should be part of the agenda of development programs
	5: Coping with hazards is rooted in people's ability to adjust their daily life to the strength of their livelihoods and social network
	5: Social networking is critical in providing alternative support in times of crisis
	5: Empowering people to make them less vulnerable in the face of natural hazards through fair access to resources
Zagonari[21]	1: A campaign to inform the general public about evacuation and trauma management
	1: An information campaign focused on young women
	1: A campaign to inform the general public about flood
	6: A risk management program that meets individual rationality and overall feasibility conditions
	1: If information campaigns and other measures are designed for special community, a flood risk management plan can be successfully implemented
Harries[22]	1, 3: Policy-makers and the designers of protection products should pay more attention to the emotional barriers and incentives against adaptation
	7: Seek to establish a more complete understanding of the relationship between protective behavior and the beliefs
Parsizadeh *et al.*[23]	7: Positive effects of the spirit and sense of place
	7: Memorial places are recommended to be built and incorporated within the cultural landscape of the places
	1: More attention should be paid to women's role and their contributions in terms of earthquake risk perception
	1: Earthquake education need to be recognized and incorporated
	1: Earthquake disaster awareness and education needs to take into account the specificity of the place as well as the impact of cultural landscape and cultural beliefs on earthquake risk perception of local communities
	3: A place-specific earthquake disaster awareness and education needs to be encouraged and developed
	1, 7: Poems, folktales, oral traditions, and myths in Iran have great potentials to warn and remind about past seismic events and disasters and to contribute to development of an "earthquake culture"
Liu *et al.*[24]	6: Role of information seeking in publics' disaster decision-making
	1: Maps increase understanding and potential compliance
	1: High information richness message components
	1, 7: Perceived proximity to a mapped hazard influences people's beliefs about risks associated with hazards
	1: Conceptual explanation
	1: Information seeking may be positively related to emotional extremes and increased prior experience
	1: Use of technology may be more influential by a wide margin than information seeking on decision clarity
Cutchin *et al.*[25]	1: Strengthening a clearer understanding of the concerns
	1: Developing stress management strategy

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Author (s) reference	DRP strategies: Findings of this study 1. Educational strategies 2. Participatory strategies 3. Incentive strategies 4. Confidence building strategies 5. Supportive strategies 6. Managerial strategies 7. Cultural strategies
Kellens *et al.*[26]	5: Hazard visibility
	1: Measured risk perception did not explicitly focus on property value and material belongings
	1: Governmental risk awareness programs should be content specific and tuned to the specific target group to be affected
	1: Insights about the psychological processes of different target groups influencing risk perception is therefore of vital importance

DRP= Disaster risk perception

event. Men tended to have internal control of events and show a low level of vulnerability.

Jones considers "marital status" as a buffer for the past injuries. A study by Zagonari highlights the positive role of marriage in postdisaster period.[28] In addition, the economic ownership of women in Burningham's study plays an effective role in perceived risk.[30] It seems that women's perception is less than their male counterparts in spite of women's greater concern for risk.

Knowledge can also raise awareness and perception about risks, vulnerability, and exposure.[30,33] Based on various studies, it is believed that the public disclosure method has the maximum impact on public understanding. According to Liu, Brook Fisher, Bernknopf *et al.*, people's feelings must be engaged and their knowledge must be enhanced in order to increase the public understanding.[15,20]

The probability of hazard impacts could be understood from a variety of perspectives such as experience, direct or indirect, which has a great effect on the creation of risk perceptions.[13,22,30] According to Harries, direct flood experience increases the belief in protecting behavior. Direct exposure to a hazard is sometimes associated with irreparable physical and properties loss. On the other hand, some disasters have a long-term return period with a lower effect on direct experience.[27]

Psychological factors

Psychological characteristics are emotions (fear and insecurity), mental images (beliefs and attitudes), as well as internal and external control. In various studies, worries, anxiety, and concern are reported as major effective variables for disaster risk perception and protective measures.[20,22] The concerns of groups were associated with a greater vulnerability to hazardous physical and mental harm.[32] Harris concluded that anxiety had a negative correlation with experience; that is, those who experienced disasters were much more worried and took more protective measures. Due to local experience of previous flood events, people had not considered their own property to be at significant risk according to findings revealed by Burninghum. That is, risk is ignored not because of lack of awareness, but due to tendency to ignore the risk.[30] According to Arma and Arven, those who have more internal control have lower levels of anxiety and are more resilient in dealing with disasters, and request less help. Conversely, those who rely on foreign control are more in need of support and security and more distrust and noncompliance.[12]

Culture factors

A culture-based approach to public research in disaster considers the perceived risk of a threat as a process of implementing the norms, values, and cultural performances of a group of people.[33] According to Wachinger *et al.*, culture, as a demographic characteristic, have a mediating and reinforcing function. Some studies concluded that faith may be more important than experience in general perception.[28] Local and regional beliefs such as "the protective spirit of the place" and religious symbols such as "palm trees," "Qantas" could increase resiliency in residents of Bam.[15] In the same vein, Botzen pointed out that the belief in the value of the place and the sense of belonging to the place were significant factors for the willingness to pay for expenditure.[34]

Socioeconomic factors

Some studies indicated that income and livelihood were effective in understanding the risk of by people.[12,13] The economic consequences of disasters depend on their destruction. Insurance payments are always considered as a means of transferring disaster damages. Policy-makers tend to consider financial motives as the major cause for the reduction of insurance coverage for flood damage, while the perception of flood rate, perception of vulnerability, and tendency to feel secure are more important for purchasing or the willingness to pay for insurance.[23,27,28]

Trust is an important factor, affecting the compliance with regulations and guidelines for risk reduction, protection, or prevention.[23,24] Trust is a two-way street, namely, the trust of people in the authorities and the trust of authorities in people. According to studies conducted in this regard, officials and people differ in attitudes and views. Experts see the general public as unaware and quite sensational, while ordinary people regard professionals as those who know less than they claim and believe that they work for governments.[25] Experts focus more on probabilities, while people concentrate on outcomes and consequences. The difference between the opinions' of officials and the people poses an obstacle against implementation of strategies for improving risk perception.[24] In his study, Zagonari concluded that the majority of people believed that disaster risk reduction was the duty of the state.[28] However, in the event of a disaster, governments will not be capable of meeting all their needs. Consequently, the government must take measures to reduce disaster risk. On the other hand, the government should try to reduce risk and vulnerability while providing fair access to land and resources.[15,23]

Strategies

The strategies to improve public risk perception comprised seven categories: educational, participatory, incentive, confidence building, supportive, managerial, and cultural. The most frequent strategy presented in the studies was the educational strategy. This strategy is investigated in terms of content, methods, tool, audience, educators, educational barriers, and educational planning [Table 2].

Discussion

Strategies that can improve Disasters Risk Perception are as follows
Educational strategies
One of best strategies for the improvement of DRP is education that can be in the form of education content, educational method, education goals, education tools, and education audience.

Education content: In several studies, educational content has been emphasized such as content specific (e.g., trauma, evacuation, or stress management) materials or poetry, story, and folktales about the past seismic events and disasters, high richness message components, maps, and conceptual explanation.[16,17,19,28,33]

Educational method: The importance of using different educational methods has been addressed in some articles, including consideration of training, internship, or practice.[19,20]

Education goals: In most studies, education in emotional domain of the risk perception was investigated. The variables studied in the field of emotional goals such as willingness, dread feeling, emotional extremes, conscious and unconscious attitudes, concern, psychometric approach, and ability of the individual to imagine the effect, could increase the degree of internal control.[20,32,35] In some studies, investigating cognitive domain; the focus was on increasing awareness and information about risk and reiterating past disaster experiences.[20,22,28] In a few studies, the psychomotor field has been mentioned. These studies have emphasized decision-making skills and stress management.[17,35] Educational tools: Educational tools mentioned in chosen studies include mass media, information campaigns, social networks, websites, maps of older people in oral traditions, and myths.[19,20,22,35]

Educational audiences: In the case of audiences, there are two different approaches toward program learning. Some studies have a general approach toward addressing the entire society (not just those "at risk"),[11,28] but others have focused on specific groups and audiences and they adopted local programs.[19,27]

Therefore, the educational approach seems to be the most important and critical approach to increase risk perception. The educational program requires accurate and specialized planning and need to take into account all of the objectives. Special attention is paid to educational content with the aim of making cognitive, emotional, and even psychomotor goals and using new and diverse educational methods for specific or all groups.

It seems that general programs are needed for infrastructure of receiving specific information about risks; however, other programs dealing with specific place, society, or risk are more cost-effective. The audience of educational programs should be identified in all programs.

Managerial strategies: Several studies have been carried out on the role of management in promoting risk perception and each has addressed different aspects of risk management to achieve disaster risk reduction. These studies have recommended considering the component of risk perception in developing programs, conducting comprehensive research to fully understand the socioeconomic status and facilitate and prevent social behaviors, performing community analysis on the degree of people's proximity to their social network, collaborative effort between different organizations, and a better and more professional attention to the issue of risk perception, and finally adoption and implementation of effective policies.[11,12,13,20,22,25,28]

Today, the perception of risk seems to have been accepted in disaster resiliency. However, the perception

of risk as a constituent of disaster risk management has not been addressed specially and professionally yet. Lack of measuring the perceived risk of society and the lack of awareness about the importance of each of its aspects have made it difficult to conduct a serious management intervention. Given that the status of studies in this area is in the initial stage, it is necessary to go beyond this stage and target further studies toward measuring the level of community perception and implementing serious interventions. Disaster risk management needs to be addressed as a permanent component of all disaster risk management plans.

Supportive strategies

Throughout the included studies, we found supportive strategies, including emotional and material ones. Emotional supportive strategies comprised stress reduction programs, facilitation of social behaviors, and informing people to meet their material needs in the potential event of disasters. Material supportive strategies include policies for creating economic and social well-being, fair distribution of resources, the importance of access to resources, addressing the problem of marginalized people, and more attention to vulnerable groups.[11-13,19,24,25,35]

It seems that the importance of supportive strategies has been taken into account in studies. However, the number of studies in this regard is low and the need to address the use of material or emotional support, or both, is felt considering the level of community perceived risk. In addition, financial support of these methods requires further investigation and provision of a strategy.

Cultural strategies: There were two kinds of perspective toward cultural strategies in chosen studies. In some studies, culture has been specifically devised in terms of special hazard; for example, the "culture of flood or earthquake" but other studies have broadened the role of community culture and considered it as a set of values, religious beliefs, or religious, historical, and spatial beliefs, suggesting individuals to have a full understanding of the risks and protective behaviors.[16,20,25,32,33]

Although studies have been carried out on the culture of disasters, many of them deal with this issue superficially. Therefore, there is a need for a case study to create a complete understanding of disasters with respect to culture of each country, region, and even each neighborhood. Investigating the culture of disasters across different nations, regions, and even families is recommended to achieve a better understanding of risk perception status.

Cultural, national, and religious beliefs may have positive or negative effects in creating the perception of disasters impact. Therefore, the identification and development of positive beliefs and the neutralization and suppression of negative beliefs require analysis, planning, and implementing strategies.

Incentive strategies: Incentive policies were mentioned in chosen studies in terms of financial and spiritual domains. Financial policies by giving interest-free or low-interest loans and spiritual policies through Islamic methods motivate citizens to have a stronger impact on risk perception and protection behavior.[19,20,22,25,24]

Incentive policies do not necessarily mean financial aid, but more attention to the perceived risk and value of avoided risk behaviors as a behavioral change.

Confidence building strategies: In the studies on confidence building strategies, the aim was to promote the implementation of risk reduction guidelines and compliance with disaster warnings. The lack of trust in authorities and information sources has also been mentioned in studies on the reasons for doubt about disaster risk reduction measures. According to these studies, trust in authorities increases through social support and can reduce stress and improve people's perceptions. External interventions abandon the likelihood of doubt over adopting long-term risk mitigation measures.[12,14,20,22]

Trusting authorities is essential for creating a social environment in critical situations. The process of establishing long-term trust should be completed before disasters. Therefore, in the predisaster stage, the reasons for people's lack of trust in the authorities in the community, if any, should be investigated.

Participatory strategies: Investigated studies elaborated on the role of participatory strategy in engaging citizens, in addition to governance, to effectively disaster risk reduction, and recommends the design of suitable risk communication with stakeholder participation. In addition, the need for understanding of the attitudes and values toward risk reduction measures is essential to achieve better protection against risks.[14,19,22,24]

Family-centered approach

In spite of more attention paid in community disaster risk management studies and adopting the community preparedness approach, this study introduced a "family-centered approach." This approach is recommended due to importance of participatory strategies as well as understanding the differences between males and females in terms of the effect of social demographic variables on risk perception. Family-centered approach, as an abstract content, can be added to all risk perception programs. In some

studies, focusing on family as a small social unit for the promotion of disaster risk reduction programs is highlighted. We propose to adopt a family-centered approach for educational, cultural, and participatory strategies due to psychological and demographic reasons. This claim is consistent with the findings of a research conducted in Romanian community revealing higher correlation between demographic variables and risk perception; and suggesting more focus on the differences between two sexes.[12]

Strengths and weaknesses of this study

The novelty of this study was the introduction of intervention strategies for natural disaster risk perception that is the first priority of Sendai framework for DRR, 2015-2030. A wide range of keywords were used for search of articles in this regard. Difficulty to access to the full text of some papers was the limitation of this study, and we acknowledge that the studied articles were not the only articles available.

Conclusion

In this study, the strategies and factors affecting the risk perception were identified, which can provide executive plans and managers useful information. These strategies were presented in seven areas of educational, participatory, managerial, supportive, cultural, trust building, and incentive, expressing the broad scope of risk perception and acknowledging the need for a comprehensive and collaborative plan. It seems that the implementation of the above-mentioned strategies with the family-center approach can help improve the risk perception of society. Particularly, the educational and participatory strategy is recommended to be developed with family focus. Given the difficulty of engaging people in reducing disaster risk, these evidence-based risk-reduction strategies in other countries can help increase public participation in programs.

Conflicts of interest

There are no conflicts of interest.

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